SUBMIT TO: Application of LIDAR to Current Atmospheric Topics
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ABSTRACT TITLE: New Tunable Laser Materials for Potential Use in LIDAR Systems

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PRESENTATION: Oral

ABSTRACT TEXT: Solid state lasers can serve as useful sources for LIDAR systems, since they can be engineered to be reliable, efficient and compact. As it turns out, however, specific wavelengths are often required to interrogate a certain molecule or atmospheric window. In order for this technology to afford maximum flexibility, different wavelength ranges must be readily available to the practitioner. We have devised new laser materials that access spectral regions in the ultraviolet and the mid-infrared.

We have found that a new laser material comprised of Cr^{2+}-doped ZnSe is capable of providing tunable laser radiation in the 2.2-3 micron region. This gain medium is efficient, offering near-unity emission yield, and laser slope efficiencies of 30% when pumped at 1.7 microns. It is the first example of the divalent chromium species serving as a laser ion, and may open the door to many new opportunities in LIDAR. Previously, it was only possible to access this region by way of optical parametric oscillators, which are effective and flexible, but more subtle to operate.

Another new laser material of potential interest to LIDAR is cerium-doped $LiSrAlF_6$, or Ce:LiSAF. This gain medium is tunable in the range of 285-310 nm in the ultraviolet, and has been found to be a viable optical material that is relatively resistant to solarization. Using the fourth harmonic of Nd:YAG at 266 nm as the pump source, a slope efficiency of 33% has been achieved. The additional introduction of the 532 nm second harmonic of the Nd:YAG pump increases the efficiency to 47% by rapidly bleaching-out the color centers. A recent collaborative experiment with Lightning Optical Corporation, Spectra Physics, and ourselves has produced a demonstration of 170 mW with the related Ce:LiCAF crystal.

KEYWORDS: Tunable laser, optical materials, Cr:ZnSe, Ce:LiSAF

*This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.